

CLAIMS

1. A method of component mounting for picking up components and mounting the same onto respective predetermined mounting positions of a circuit substrate by means of a plurality of nozzles connected to a single vacuum generating source, wherein the method including procedures for preventing occurrence of defective circuit substrates due to missing component, said procedures comprising steps of:

initializing achieved vacuum pressure of a nozzle after completion of component pick up operation to zero;

detecting vacuum pressure decrease of the nozzle from the initialized zero value; and

if the detected vacuum pressure decrease exceeds predetermined first threshold, making a judgment that the nozzle has failed to pick up a component, and skipping component mounting operation by that particular nozzle.

2. The method according to claim 1, further comprising steps of:

before initializing the achieved vacuum pressure of a nozzle to zero, detecting absolute value of the vacuum pressure achieved by the nozzle after completion of component pick up operation, and

if the detected achieved vacuum pressure is lower than

predetermined second threshold, shutting a vacuum air passage of that particular nozzle.

3. The method according to claim 2, further comprising
5 steps of:

imaging each of the nozzles with a recognition camera;
and

identifying which nozzle has failed to pick up a
component based on the obtained images.

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4. The method according to claim 3, further comprising
steps of:

after identifying the nozzle that has failed to pick
up a component based on the obtained images, shutting a
15 vacuum air passage of that identified nozzle;

imaging the identified nozzle one more time, and
detecting whether or not a component is still carried by
the nozzle.

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5. The method according to claim 2, wherein the nozzles
perform component mounting operations, excluding the nozzle
that is judged to have failed to pick up a component and
the nozzle whose vacuum air passage is shut.

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6. Component mounting apparatus comprising:

a vacuum generating source;

a plurality of nozzles connected to said vacuum generating source, each of which nozzles has a control valve capable of shutting a vacuum air passage;

5 a mounting head being supported in a movable manner and holding said plurality of nozzles;

a component recognition device positioned to face with the mounting head for recognizing components held by the nozzles; and

10 a controller for controlling operations of the component mounting apparatus in accordance with a method according to any one of the preceding claims.

7. A method of component mounting for picking up a
15 component by means of vacuum sucking effect of a nozzle, and separating the component from the nozzle and mounting the same onto a predetermined mounting position of a circuit substrate by means of air blowing effect of the nozzle, wherein the method including procedures for
20 preventing occurrence of defective substrates, which procedures comprising steps of;

measuring air flow volume blown from the nozzle at an air flow passage at a timing immediately after completion of component mounting operation, which air flow passage is
25 provided for supplying pressurized air to the nozzle; and

making a judgment that the component has not been mounted onto the circuit substrate, if the measurement value is smaller than a predetermined threshold.

- 5 8. The method according to claim 7, wherein the threshold comprising two thresholds, and said procedures comprising steps of:

 making a judgment that the component has not been mounted onto the circuit substrate, if the measurement
10 value is smaller than both of the thresholds; and

 making a judgment that the component has been mounted onto the circuit substrate, but that a filter disposed at the air flow passage is clogged, if the measurement value is in between the two thresholds.

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9. The method according to claim 8, wherein said procedures comprising steps of:

 measuring blowing air flow volume at two different timings immediately after completion of component mounting
20 operation;

 making a judgment whether or not the component has been properly mounted onto the circuit substrate based on the first measurement value; and

 making a judgment either the component has been
25 mounted onto the circuit substrate but the filter is

clogged, or the component has not been mounted onto the circuit substrate based on the second measurement value.

10. A method of component mounting for picking up a
5 component by means of vacuum sucking effect of a nozzle,
and separating the component from the nozzle and mounting
the same onto a predetermined mounting position of a
circuit substrate by means of air blowing effect of the
nozzle, wherein the method including procedures for
10 preventing occurrence of defective substrates, which
procedures comprising steps of;

measuring differential of air flow volume blown from
the nozzle at an air flow passage at a timing immediately
after completion of component mounting operation, which air
15 flow passage is provided for supplying pressurized air to
the nozzle; and

making a judgment that the component has not been
mounted onto the circuit substrate, if the differential of
air flow volume decrease obtained by the measurement is
20 bigger than a predetermined threshold.

11. The method according to claim 10, wherein the
threshold comprising two thresholds, and said procedures
comprising steps of:

25 making a judgment that the component has not been

mounted onto the circuit substrate, if the differential of air flow volume decrease obtained by the measurement is bigger than both of the thresholds; and

5 making a judgment that the component has been mounted onto the circuit substrate, but that a filter disposed at the air flow passage is clogged, if the differential of air flow volume decrease obtained by the measurement is bigger than one of the thresholds but smaller than the other.

10 12. The method according to claim 11, wherein said procedures comprising steps of:

measuring differential of air flow volume at two different timings immediately after completion of component mounting operation;

15 making a judgment whether or not the component has been properly mounted onto the circuit substrate based on the first measurement result; and

making a judgment either the component has been mounted onto the circuit but the filter is clogged, or the component has not been mounted onto the circuit substrate
20 based on the second measurement result.

13. A method of component mounting for picking up a component by means of vacuum sucking effect of a nozzle,
25 and separating the component from the nozzle and mounting

the same onto a predetermined mounting position of a circuit substrate by means of air blowing effect of the nozzle, wherein the method including procedures for preventing occurrence of defective substrates, which procedures comprising steps of;

measuring blowing air pressure blown from the nozzle at an air flow passage at a timing immediately after completion of component mounting operation, which air flow passage is provided for supplying pressurized air to the nozzle; and

making a judgment that the component has not been mounted onto the circuit substrate, if the measurement value is bigger than a predetermined threshold.

14. The method according to claim 13, wherein the threshold comprising two thresholds, and said procedures comprising steps of:

making a judgment that the component has not been properly mounted onto the circuit substrate, if the measurement value is bigger than both of the thresholds; and

making a judgment that the component has been mounted onto the circuit substrate, but that a filter disposed at the air flow passage is clogged, if the measurement value is in between the two thresholds.

15. The method according to claim 14, wherein said procedures comprising steps of:

measuring blowing air pressure at two different
5 timings immediately after completion of component mounting operation;

making a judgment whether or not the component has been properly mounted onto the circuit substrate based on the first measurement value; and

10 making a judgment either the component has been mounted onto the circuit substrate but the filter is clogged, or the component has not been mounted onto the circuit substrate based on the second measurement value.

15 16. A method of component mounting for picking up a component by means of vacuum sucking effect of a nozzle, and separating the component from the nozzle and mounting the same onto a predetermined mounting position of a circuit substrate by means of air blowing effect of the
20 nozzle, wherein the method including procedures for preventing occurrence of defective substrates, which procedures comprising steps of;

measuring differential of blowing air pressure blown from the nozzle at an air flow passage at a timing
25 immediately after completion of component mounting

operation, which air flow passage is provided for supplying pressurized air to the nozzle; and

making a judgment that the component has not been mounted onto the circuit substrate, if the differential of blowing air pressure decrease obtained by the measurement is smaller than a predetermined threshold.

17. The method according to claim 16, wherein the threshold comprising two thresholds, and said procedures comprising steps of:

making a judgment that the component has not been mounted onto the circuit substrate, if the differential of blowing air pressure decrease obtained by the measurement is smaller than both of the thresholds; and

making a judgment that the component has been mounted onto the circuit substrate, but that a filter disposed at the air flow passage is clogged, if the differential of blowing air pressure decrease obtained by the measurement is smaller than one of the thresholds but bigger than the other.

18. The method according to claim 17, wherein said procedures comprising steps of:

measuring differential of air flow volume at two different timings immediately after completion of component

mounting operation;

making a judgment whether or not the component has been properly mounted onto the circuit substrate based on the first measurement result; and

5 making a judgment either the component has been mounted onto the circuit but the filter is clogged, or the component has not been mounted onto the circuit substrate based on the second measurement result.

10 19. A method of component mounting for picking up a component by means of vacuum sucking effect of a nozzle, and separating the component from the nozzle and mounting the same onto a predetermined mounting position of a circuit substrate by means of air blowing effect of the
15 nozzle, wherein the method including procedures for preventing occurrence of defective substrates, which procedures comprising steps of;

measuring either one of blowing air flow volume, differential of blowing air flow volume decrease, blowing
20 air pressure, or differential of blowing air pressure decrease of the air blown from the nozzle at an air flow passage at a timing immediately after completion of component mounting operation, which air flow passage is provided for supplying pressurized air to the nozzle;

25 comparing the result of the measurement with a

predetermined corresponding threshold;

making a judgment that the component has been separated from the nozzle and mounted onto the circuit substrate properly, if the blowing air flow volume or the differential of blowing air pressure decrease is bigger than the corresponding predetermined threshold, or the differential of blowing air volume decrease or blowing air pressure is smaller than the corresponding predetermined threshold, and then performing next round component pick up operation;

making a judgment that the component has not been separated from the nozzle and that the circuit substrate is missing the component, if the blowing air flow volume or the differential of blowing air pressure decrease is smaller than the corresponding predetermined threshold, or the differential of blowing air volume decrease or blowing air pressure is bigger than the corresponding predetermined threshold;

stopping the component mounting apparatus;
checking the nozzle, removing the component carried by the nozzle, and confirming that the nozzle is in a proper condition; and

restarting the component mounting apparatus for next round component pick up operation.

20. A method of component mounting for picking up a component by means of vacuum sucking effect of a nozzle, and separating the component from the nozzle and mounting the same onto a predetermined mounting position of a circuit substrate by means of air blowing effect of the nozzle, wherein the method including procedures for preventing occurrence of defective substrates, which procedures comprising steps of;

measuring either one of blowing air flow volume, differential of blowing air flow volume decrease, blowing air pressure, or differential of blowing air pressure decrease of the air blown from the nozzle at an air flow passage at a timing immediately after completion of component mounting operation, which air flow passage is provided for supplying pressurized air to the nozzle;

comparing the result of the measurement with a first predetermined corresponding threshold;

making a judgment that the component has been separated from the nozzle and mounted onto the circuit substrate properly, if the blowing air flow volume or the differential of blowing air pressure decrease is bigger than the corresponding predetermined first thresholds, or the differential of blowing air flow volume decrease or blowing air pressure is smaller than the corresponding predetermined first threshold, and then performing next

round component pick up operation;

comparing the result of the measurement with a second
corresponding predetermined threshold, if the blowing air
flow volume or the differential of blowing air pressure
5 decrease is smaller than the corresponding predetermined
first threshold, or the differential of blowing air flow
volume decrease or the blowing air pressure is bigger than
the corresponding predetermined first threshold;

making a judgment that the component has been mounted
10 onto the circuit substrate but that a filter disposed at an
air flow passage is clogged, and generating an alarm, if
the blowing air flow volume or the differential of blowing
air pressure decrease is bigger than the corresponding
predetermined second thresholds, or the differential of
15 blowing air flow volume decrease or blowing air pressure is
smaller than the corresponding predetermined second
threshold;

making a judgment that the component has not been
separated from the nozzle and that the circuit substrate is
20 missing the component, if the blowing air flow volume or
the differential of blowing air pressure decrease is
smaller than the corresponding predetermined second
threshold, or the differential of blowing air volume
decrease or the blowing air pressure is bigger than the
25 corresponding predetermined second threshold;

stopping the component mounting apparatus;

checking the nozzle, removing the component carried by the nozzle, and confirming that the nozzle is in a proper condition; and

5 restarting the component mounting apparatus for next round component pick up operation.

21. The method according to claim 20, wherein, after the step of generating an alarm, said procedures further
10 comprising steps of:

stopping the component mounting apparatus;

checking the nozzle, removing the component carried by the nozzle, and confirming that the nozzle is in a proper condition; and

15 restarting the component mounting apparatus for next round component pick up operation.

22. The method according to claim 20, wherein the procedures comprising step of:

20 measuring either one of blowing air flow volume, differential of blowing air flow volume decrease, blowing air pressure, or differential of blowing air pressure decrease of the air blown from the nozzle at an air flow passage at two different timings immediately after
25 completion of component mounting operation, which air flow

passage is provided for supplying pressurized air to the nozzle;

comparing the result of the first measurement with the first threshold; and

5 comparing the result of the second measurement with the second threshold.

23. The method according to claim 19, wherein, between the step of making a judgment that the circuit substrate is
10 missing a component and the step of stopping the component mounting apparatus, said procedures further comprising steps of:

discarding the component carried by the nozzle;

skipping the component pick up and component mounting
15 operations at next round component mounting cycle;

measuring either one of blowing air flow volume, differential of blowing air flow volume decrease, blowing air pressure, or differential of blowing air pressure decrease of the air blown from that particular nozzle at a
20 timing immediately after air blowing operation;

comparing the result of the measurement with the corresponding predetermined threshold or the first threshold;

making a judgment that the component has been
25 discarded properly and performing next round component pick

up operation without stopping the component mounting apparatus, if the blowing air flow volume or the differential of blowing air pressure decrease is bigger than the corresponding predetermined threshold or the first threshold, or the differential of blowing air flow volume decrease or blowing air pressure is smaller than the corresponding predetermined threshold or the first threshold, and then performing next round component pick up operation;

10 making a judgment that the component has not been discarded properly, if the blowing air flow volume or the differential of blowing air pressure decrease is smaller than the corresponding predetermined threshold or the first threshold, or the differential of blowing air flow volume decrease or blowing air pressure is bigger than the corresponding predetermined threshold or the first threshold.

24. The method according to claim 19, wherein after the step of making a judgment that the circuit substrate is missing a component, said procedures further comprising a step of confirming whether or not the component to be mounted on the circuit substrate is actually missing from the circuit substrate by checking that particular circuit substrate.

25. The method according to claim 19, wherein when it is judged that the circuit substrate is missing a component, the procedures further includes steps of:

5 picking up the missing component; and
 mounting the component onto that particular circuit substrate for recovering the missing component.

26. A component mounting apparatus comprising:

10 component supply for supplying component continuously;
 a mounting head having nozzles for picking up components from the component supply by means of air sucking effect, and separating and mounting the components onto predetermine respective mounting positions of a
15 circuit substrate by means of air blowing effect;
 a substrate holder for transporting and positioning the circuit substrate;
 an air sucking/blowing mechanism connected to the nozzles for providing air sucking effect and air blowing
20 effect to the nozzle; and

 a controller for controlling overall operations of the component mounting apparatus, wherein the air sucking/blowing mechanism further comprising:

 either one of a measuring meter capable of measuring
25 blowing air flow volume or differential of the blowing air

flow volume, or a pressure meter capable of measuring blowing air pressure or differential of the blowing air pressure, either one of which is disposed at an air flow passage for supplying pressurized air to the nozzle, and
5 for measuring either blowing air volume or pressure at a timing immediately after completion of blowing air; and

a controller for comparing the measuring result obtained by either one of the meters with a corresponding preliminary inputted threshold, and for making a judgment
10 whether or not the component has been mounted properly.

27. The component mounting apparatus according to claim 26, wherein the preliminary inputted threshold comprising two thresholds, and the controller being designed to make a
15 judgment whether or not the component has been mounted properly or not based on comparison between the measurement result and the first threshold, and/or making judgment either the component has been mounted onto the circuit substrate but the filter is clogged, or the component has
20 not been mounted onto the circuit substrate based on comparison between the measurement result and the second threshold.

28. The component mounting apparatus according to claim 27,
25 wherein the measuring meter or the pressure meter measuring

either one of blowing air flow volume, differential of blowing air flow volume decrease, blowing air pressure or differential of blowing air pressure decrease at two different timings immediately after air blowing operation;

5 and

the controller making a judgment whether or not the component has been properly mounted onto the circuit substrate based on comparison between the first measurement result and the corresponding first threshold, and making a judgment either the a filter disposed at air flow passage is clogged, or the component has not been mounted based on comparison between the second measurement value and the corresponding second threshold.

15 29. The component mounting apparatus according to claim 26, wherein the nozzle is structured to suck a component having a span length of equal to or less than 1.0mm.